PART ~~1~~2 A

PARTICULAR ELECTRICAL PLANT REQUIREMENTS

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PPART 12 A

PARTICULAR ELECTRICAL PLANT REQUIREMENTS

2.1 Introduction

The specific design and performance requirements for all electrical equipment are given in this part of the Specifications. The Requirement specified shall be fully met with by the Contractor. In case of any deviations, the Contractor shall bring out the same in "Schedule of Deviations from Particular Requirement" failing which it will be considered that the Contractor fully complies with these requirements.

2.2 Scope of works

The scope of works includes design, manufacture, testing at works, supply and delivery at site, unloading and storing the equipment at site of installation, testing and commissioning of the following equipment at site:-
~~11kV/0.433kV transformers, 11kV Metal enclosed Switchboards,~~ 415V Metal enclosed switchboards/distribution boards/motor control centres, ~~415V capacitor banks with APFCR panel, Diesel Generator Sets, Battery , Battery charger ,DC Distribution board,~~ Variable Frequency ~~d~~Drives ~~,Non segregated~~ bus ducts, L~~ighting system, P~~ower & ~~c~~Control cables, H.T cables, L.T cables, Cable carrier system,-& Earthing ~~& Lightning protection system..~~

All equipment/items have to be of makes as specified in the list of preferred makes. Various equipment /items shall conf~~o~~irm to latest applicable standards specified. In case of Conflict between standards and this specification, this specification shall govern.

12.1 Primary Power Source
12.2
12.3 The proposed STP & TSPS locations at Kengeri are at new places and the Electrical power supply for these locations shall be derived at 11 kV ,3 phase,50 Hz from the nearest KPTCL/BESCOM's substation. The KPTCL/BESCOM will be making necessary modification in their substation by adding extra 11kV Switchgears, Laying 11kV under ground cable up to the Double Pole structure in STP / TSPS location. Necessary double pole structure ,lightning arrestors,11 kV Isolators, CT's, PT's,interconnecting cable from double pole structure to metering unit and the metering unit will be provided by KPTCL/BESCOM. This work will be executed by KPTCL/BESCOM parallely and fund required for executing this work is included as provisional sum in the contract which will be paid directly to KPTCL/BESCOM. The Contractor's scope includes laisoning with KPTCL/BESCOM for getting progress of above mentioned work.
12.4
12.5
12.6 The Contractor's scope starts from the outgoing of indoor 11kV metering unit provided by KPTCL/BESCOM and all equipment/items as given above in clause 12.2, Scope of works .
12.7
12.8 Power supply arrangement inside the plant
12.9
12.10 The power supply arrangement for TSPS & STP shall be as per Single line diagrams, Drawing No. NMT/BWSSP-II/S1b/ KEN/E/1001 , NMT/BWSSP-II/S1b/ KEN/E/1002.
12.11
12.12 General Design Criteria
12.13
12.14
12.1.1 11kV System
12.1.1

a)	Nominal voltage	:	11kV
b)	Number of phases	:	3
c)	c) Frequency	:	50 Hz
d)	Connection		3 Wire
e)	Maximum Fault Level		500 MVA

12.1.1 ~~LV System~~

~~**12.1.1**~~

~~**12.1.1 General Supply**~~

~~**12.1.1**~~

~~**12.1.1 Voltage: 415 V nominal**~~
~~**12.1.1 Frequency: 50 Hz**~~
~~**12.1.1 Connection 4 wire**~~
~~**12.1.1 No load transformer voltage 433 V**~~
~~**12.1.1 System earthing Solidly earthed**~~
~~**12.1.1 Maximum fault level 36 MVA**~~

~~**12.1.1**~~

~~**12.1.1 All Plant shall, unless otherwise specified, be capable of continuous operation at a voltage level in the range of 90% to 110% of the relevant nominal voltage and a frequency variation of plus 5% minus 5%with a maximum combined tolerance of 10%.**~~

~~**12.1.1**~~

~~**12.1.1 AC Control , Lighting and Space Heating**~~

~~**12.1.1**~~

~~**12.1.1 Voltage: 240 V**~~
~~**12.1.1 Phases: 1**~~
~~**12.1.1 Frequency 50 Hz**~~
~~**12.1.1 Connection 2 wire (Phase & Neutral)**~~

~~**12.1.1**~~

~~**12.1.1 DC Control , Protection and Alarm**~~
~~**12.1.1 - Voltage: 110 V**~~
~~**12.1.1 - Phases: 1**~~
~~**12.1.1 -Connection 2 wire (unearthed)**~~

~~**12.1.1**~~

~~**12.1.1 11kV Indoor Switchboard**~~

~~**12.1.1**~~

~~**12.1.1 11kV Switchboard shall be indoor, floor standing, sheet metal enclosed with IP4X degree of protection, with draw out type vacuum circuit breakers for incoming & outgoing feeders, control & protection .The switchboard shall be rated for a fault current not less than 26.25 kA. All protective relays shall be numerical type.**~~

~~**12.1.1**~~

~~**12.1.1**~~

~~**12.1.1 Distribution Transformers**~~

~~**12.1.1**~~

~~**12.1.1 There shall be three load centre substations one at STP and second at TSPS and third near process blower building. The indoor 11kV metering unit will be located at STP substation ,which will have 2nos 11kV / 0.433kV Transformers which will be feeding the entire load of Sewerage Treatment plant other than process air blowers ,.**~~
~~**12.1.1 2 Nos 11kV/ 0.433kV Transformers which shall be located near Process Air Blower Building. will be feeding supply to dedicatedly process blowers of Sewage Treatment Plant .**~~

12.1.1 The TSPS substation will be having 2 nos 11kV / 0.433kV transformer which will be feeding the main pumps and auxillary loads in TSPS.

12.1.1

12.1.1 The transformers shall be sized considering 10% Contingency of total working load while arriving at the final capacity of transformers. Two no of transformers shall be provided in each substation such that under normal condition, each transformer will be loaded up to 50% and in case of failure of any one transformer, the healthy transformer shall have capacity to take entire load so as to have 100 % standby. The transformer shall be designed such that at any point of time maximum loading on any single transformer shall not exceed 80% of full load capacity.

12.1.1

12.1.1 System Protection

12.1.1

12.1.1 A microprocessor based protection system for various parts of the power supply system is proposed. The following protection systems shall be used:

12.1.1

12.1.1 (a) 11 kV Incomer Feeder

12.1.1

12.1.1 - Instantaaneous phase overcurrent relay;
12.1.1 - Instantaneous earth fault relay;
12.1.1 - inverse definite minimum time phase over current relay;
12.1.1 -
12.1.1 - potential transformer fuse failure relay;
12.1.1 -
12.1.1 - under voltage relay.

12.1.1

12.1.1 (b) 11 kV Transformer Feeder

12.1.1

12.1.1 - inverse definite minimum time over current with instantaneous over current element;
12.1.1 - instantaneous earth fault relay
12.1.1 - standby earth fault.
12.1.1 - winding temperature high, alarm trip.
12.1.1 - oil temperature high, alarm trip.
12.1.1 - Buchholz relay with alarm and trip contacts.
12.1.1 - Magnetic oil level gauge with alarm contacts.
12.1.1 - Restricted Earth Fault relay to be provided for Transformer rating more than 2MVA.

12.1.1

12.1.1 (c) 415 V Incomer Feeder

12.1.1

12.1.1 - Overload , Earth fault and short circuit protection ;
12.1.1 - Under voltage relay.

12.1.1

~~**12.1.1 (d) LV Motors**~~
~~**12.1.1**~~
~~**12.1.1 (i) Motors less than 15 kW**~~
~~**12.1.1**~~
~~**12.1.1 - overload protection by three phase thermal (bimetal) relay.**~~
~~**12.1.1 - Single phasing preventor.**~~
~~**12.1.1**~~
~~**12.1.1 (ii) Motors 15 kW up to 132kW**~~
~~**12.1.1**~~
~~**12.1.1 - electronic motor protection relay providing the following protection for**~~
~~**12.1.1 - overload;**~~
~~**12.1.1 - earth fault;**~~
~~**12.1.1 - phase currents out of balance.**~~
~~**12.1.1 - Single phasing preventor.**~~
~~**12.1.1**~~
~~**12.1.1 (iii) Motors 132kW and above**~~
~~**12.1.1**~~
~~**12.1.1 - Comprehensive motor protection relay providing the following protection for**~~
~~**12.1.1 - overload;**~~
~~**12.1.1 - locked rotor;**~~
~~**12.1.1 - Over current;**~~
~~**12.1.1 - earth fault;**~~
~~**12.1.1 - phase currents out of balance.**~~
~~**12.1.1 - Over voltage & under voltage;**~~
~~**12.1.1 - phase loss/reversal;**~~
~~**12.1.1 - negative sequence;**~~
~~**12.1.1 - Protection for repeated and prolonged starts;**~~
~~**12.1.1 - restart inhibition;**~~
~~**12.1.1 - no load running;**~~
~~**12.1.1 - Single phasing preventor.**~~
~~**12.1.1**~~
~~**12.1.1**~~
~~**12.1.1 Switchgear Equipment / Instruments**~~
~~**12.1.1**~~
~~**12.1.1 (a) 11 kV Feeders (Incomer and Transformer feeders)**~~
~~**12.1.1**~~
~~**12.1.1 - ammeter on all 3 phases;**~~
~~**12.1.1 - voltmeter with selector switch;**~~
~~**12.1.1 - kW meter;**~~
~~**12.1.1 - kWh meter;**~~
~~**12.1.1 - KVArh meter;**~~
~~**12.1.1 - Frequency meter;**~~
~~**12.1.1 - power factor meter.**~~
~~**12.1.1**~~
~~**12.1.1 (b) 415V Incomer Feeders**~~
~~**12.1.1**~~
~~**12.1.1 - ammeter on all 3 phases;**~~

~~**12.1.1 - voltmeter with selector switch;**~~
~~**12.1.1**~~
~~**12.1.1 (c) 415V Motor Starters**~~
~~**12.1.1**~~
~~**12.1.1 - DOL Starters for motor feeders less than or equal to 5.5 kW ;**~~
~~**12.1.1 - Star-Delta Starters for motor feeders above 5.5 kW and less than or**~~
~~**12.1.1 equal to 250 kW ;**~~
~~**12.1.1 - Soft Starters for motor feeders above 250 kW ;**~~
~~**12.1.1**~~
~~**12.1.1**~~
~~**12.1.1**~~
~~**12.1.1**~~
~~**12.1.1**~~
~~**12.1.1 Standby Diesel Generator Sets**~~
~~**12.1.1**~~
~~**12.1.1 Three shall be two nos Standby Diesel Generator Sets of same capacity with AMF Control Panel , Synchronising Panel etc.The combined capacity of the Generators shall be sized for 100% power back up for entire facility consisting of Sewage Treatment Plant and Terminal Sewage Pumping Station and 10% Contingency over these loads shall be considered while sizing the DG Sets. The DG Sets shall be reated for 11kV, 3 phase , 50 Hz. The DG sets shall be with acoustic enclosures .**~~
~~**12.1.1**~~
2.3

415 V PCC / MCC

415 V PCC/MCC shall be floor standing–,_sheet steel enclosed with Form – IV enclosure as per IS 8623 with Air circuit breakers/MCCB's /Switch fuse units–, Control & Protection–. The PCC /MCC shall be rated for a fault current not less than 50 KA.

Each motor shall be provided with a press to lock and twist to release type local emergency stop button with mushroom head.

Pump Drives

Where practical all pumps shall be provided with the following additional protection:

- run dry protection;
- over pressure ~~(positive displacement pumps)~~.

Blowers

Blowers shall be provided with the following additional protection:

- Over pressure.

Rotating Arm Drives

Rotating arm drives shall be provided with the following additional protection:

- motion detectors;
- over torque detectors.

Valve Actuator Drives

Valve actuator drives shall be provided with the following additional protection:

- Over torque detectors.

12.1.1 ~~L.T Capacitor Bank and Power Factor Correction~~

~~The capacitor banks provided shall be of bus connected type with Automatic Power factor correction, the system shall be designed such that a power factor of not less than 0.98 is maintained.~~

~~Automatically controlled multistage power factor correction shall be provided. 2 Nos. PFC panels providing no less than 8 No PFC stages per panel shall be provided each connected to one bus section of the distribution board. The PF on each half of the board shall be monitored and corresponding PFC capacitors switched in and out automatically in discrete stages in order to maintain a set point PF value.~~

~~Each panel shall be configured such that no PFC capacitor stages shall operate when the standby generator is powering the side of the distribution board to which it is connected.~~

~~The breakers and cables in capacitor circuit shall be designed for taking extra loading of 35%.~~

2.4 Variable Frequency Drives

Following minimum loads shall be provided with Variable frequency Drives,

- Process Air Blowers
- Thickened Sludge Pumps
- TSPS Raw Sewage Pumps ~~– 2 Nos~~
- Primary Sludge Pumps
- Return Activated Sludge Pumps
- Mixer ~~l~~Liquor Recirculation Pumps
- Centrifuge feed Pumps
- ~~Dewatering pump for Centrifuge~~

The starters for the above loads will be located in outgoing feeders of corresponding MCC. The Variable Frequency Drives shall be provided with By pass circuits with timers such that Starters will come in to circuit only at starting condition and get by passed once the load reaches its normal working condition and after that speed control is achieved through
Variable Frequency Drive.

2.5 DC Power Supply

The existing DC Power supply shall be ~~provided~~utilized for protection and control in ~~11kV~~ and 415V Switchgears ~~and for DC emergency lighting~~.

~~A Conventional system operating at 110V DC using maintenance free rechargeable Ni-Cd batteries shall be provided and shall be complete with battery, battery charger with boost & trickle charging facilities , necessary controls ,indications and DC distribution board.~~

2.6 Cabling

(a) ~~HV Power Cables~~
~~(b)~~

~~HV cables shall be 3 core , 11kV(UE) , XLPE type with aluminium conductors & GI armouring . Minimum size of cable shall be selected based on the short circuit considerations.~~

~~(c)~~ LV Power Cables

LV multi-core cables for use on 415 V and 240 V power supply systems shall be XLPE / PVC type with aluminium conductors for sizes 6 sqmm and above and Copper Conductors for sizes below 6sqmm.

(d) Cable Rating

All power cables shall be sized for continuous current carrying capacity and permissible voltage drop at an ambient temperature of 45 degrees C. Due consideration shall be taken of cable grouping, method of installation and local variations in ambient conditions. Further, for cables controlled by circuit breakers, due consideration shall be given to the fault level.

~~HV and~~ LV cables shall be sized for a minimum fault clearance time of 0.5 second for incoming feeders and 0.16 second for equipment feeders

In general power cables will be sized to limit the maximum voltage drop of 3 % corresponding to rated / estimated full load.

(e) Cable Installations

Heavy duty galvanized iron cable tray and ladder racking shall be used for cable support systems. These shall be used to route cables along walls ,below beams and within cable trenches. Cables shall be securely fixed to the support systems. Bundling of cables shall be permitted where allowance for this practice has been made while sizing the cables.

Cables of different categories shall be installed so as to maintain satisfactory clearances for safety and in order to reduce the possibility of electrical interference. The following Table details the distances in mm that shall be maintained between the different categories of cables.

Table of Separation Distances between different Categories of Cable

Cable Category	HV Power	LV	C&I/	Telecomms

		Power	Protection	
~~HV Power~~	~~N/A~~	~~300~~	~~500~~	~~500~~
LV Power	300	N/A	300	300
C&I/Protection	500	300	N/A	100
~~Telecomm~~	~~500~~	~~300~~	~~100~~	~~N/A~~

~~(f)~~ Cable Numbering

All cables shall be allocated a unique number which will be fixed to each end of the cable using a corrosion resistant label. Cables of different categories will be tagged with the following subscripts and a three digit number.

- ~~HV power HV-P_ _ _~~
- LV power P_ _ _
- Control C_ _ _
- Instrumentation I_ _ _
- Protection PR_ _ _
- Telecommunication T_ _ _

12.1.1 Building Services
12.1.1
12.1.1 Lighting
12.1.1
12.1.1 All internal and external areas shall be provided with lighting. The illumination levels to be achieved shall be as follows:
12.1.1

Area	**Illumination Level (Lux)**
Pump house	200 Lux
Battery room	150 Lux
Machinery service area	200 Lux
Offices and conference rooms	300 Lux
Switchgear room , DG room	200 Lux
Control rooms/ SCADA room	300 Lux
Chemical and general stores	150 Lux
Chemical plant room	200 Lux
Cable basement	100 Lux
All other indoor areas	100 Lux
Outdoor platforms and walk ways	50 Lux
Building entrance	100 Lux
Outdoor plant areas	20 Lux
Outdoor transformer yards -- General -- On equipment	 10 Lux 30 Lux
Roads (secondary)	10 Lux

Luminaires for internal lighting shall be of fluorescent / high pressure sodium vapour types. The latter type shall be used for large high bay areas such as the pump house. However even in the pump house these luminaires will be supplemented with fluorescent luminaires to assure that minimum illumination levels are maintained following momentary power dips which could extinguish the discharge lights for several minutes. All other internal areas will be lit with fluorescent luminaires.

Luminaires for outside areas shall be of the high pressure sodium vapour type.

Ceiling fans shall be provided in offices, control rooms and they shall be connected to local lighting circuit.

The lighting installations shall be designed using a maintenance factor of 0.8.

The internal lighting installation shall be installed using single core, PVC insulated copper cable enclosed in galvanised iron conduit. Lighting in external areas shall be installed using multicore armoured cable.

(a) Emergency Lighting

Self contained emergency luminaires shall be provided in all internal areas. These luminaires shall automatically illuminate in the event of a power failure and provide a minimum level of lighting for approximately 3 hours. They shall automatically recharge on the return of mains power.

(b) Ventilation Fans

Variable speed ventilation ceiling fans shall be provided in offices, conference rooms, laboratories, control rooms, control areas and switchgear rooms. One fan shall be provided for each 10 m^2 or part thereof of the area concerned.

Where fitted ceiling fans shall be connected to the local lighting circuit.

(c) Small Power Outlets

Switched single phase three pin 5 A and 15A receptacles shall be provided throughout. In offices and control rooms they shall be the decorative type and industrial type in all other areas.

Unless required to be provided in greater numbers to power specific Plant items the number of such outlets shall be as follows:

5 A type — one outlet per 5 m or part thereof of perimeter in offices and laboratories;
5 A type — one outlet per 20 m or part thereof of perimeter in all other areas;
15 A type — one outlet per 20 m or part thereof of perimeter in offices and laboratories;

~~15 A type one outlet per 20 m or part thereof of perimeter in all other areas.~~

~~30 A switched three phase and neutral receptacles shall be provided in plant areas where appropriate i.e. adjacent to areas where flooding is likely (to permit the use of portable sump pumps) or where other portable equipment is likely to be used in the operation of the treatment plant. The Contractor shall install ten such outlets at various locations throughout the treatment plant.~~

~~The location of outlets shall be approved by the Engineer. The spacing of 5 A and 15 A outlets shall be arranged to suit the intended location of equipment, desks etc.~~

~~Receptacles for outside areas shall have a degree of protection of IP 55.~~

2.7 System Earthing

An earthing system comprising earth electrodes and conductors shall be established for Sewage Treatment Plant and Terminal Sewage Pumping Station and –the two networks shall be interconnected.

The earthing system will be designed to give a combined earth resistance value of not greater than 1 ohm. In order to be sure of obtaining suitable final values, soil resistivity shall be measured at the various sites during the detailed design phase of the work.

~~In outdoor substation areas the main earth electrode conductors shall be located, to ensure potential gradients occurring at the surface during fault conditions are kept within allowable limits.~~

Materials used for earth electrodes shall be designed to suit the ground conditions and shall either be plain mild steel or Galvanised steel.

The system shall be designed for the following maximum earth fault currents. These values will be confirmed at the detailed design phase.

~~- 11 kV system 26.25 kA.~~
- 415 V system 50 kA.

The fault clearing time shall be taken as three seconds for the ~~11 kV and~~ 415 V systems.

The maximum temperature allowed for steel welded joints will be taken as 500 degrees C with an ambient of 45° C._Main equipotential bonding conductors shall be galvanised steel.

Circuit protective conductors will comprise either the armouring of the supply cable or, for major loads such as main switchboards and large drives the supply cabling plus an additional suitably sized single core copper cable.

The neutral point of the ~~11/0.433 kV transformer secondary windings~~equipments shall be solidly earthed.

13.~~11 kV Metal Enclosed Switchboards~~

~~Sr. No.~~	~~Description~~	~~Unit~~	~~Technical Particulars~~
~~12.6.1~~	~~Make~~		~~As per Preferred Makes/Manufacturers of Part 6, General requirement.~~
~~12.6.2~~	~~Type~~		~~As per Specification~~
~~12.6.3~~	~~Applicable Standards~~		~~As per Specification~~
~~12.6.4~~	~~Quantity~~	~~No.~~	~~(*)~~
~~12.6.5~~	~~**Switchgear cubicles and Bus bar ratings**~~		
~~(a)~~	~~Rated voltage, phases and frequency~~		~~11kV ,3 phase , 50 Hz~~
~~(b)~~	~~System Neutral Earthing~~		~~Resistance earthed~~
~~(c)~~	~~Maximum system voltage~~	~~kV~~	~~12~~

Sr. No.	Description	Unit	Technical Particulars
(d)	One minute power frequency withstand voltage	kV (rms)	28
(e)	12/50 μsec impulse withstand voltage	kV (peak)	75
(f)	Short circuit withstand		
	(i) Short time (1 sec) at rated voltage	kA(rms)	25
	(ii) Dynamic rating	kA(peak)	62.5
(g)	Reference ambient temperature		45 °C
(h)	Maximum temperature of bus bars droppers connectors and contacts at continuous current rating under site reference ambient temperature		Joints, Silver faced : 100°C Busbars and other joints : 85° C
(i)	Continuous current rating of bus bar	A	(*)
(j)	Bus bar material		Copper
(k)	Bus bar Insulation		Fully insulated by encapsulation in epoxy resin with mould caps protecting all joints
(l)	Cable entry		Bottom
(m)	Cable type for Incoming and Outgoing feeders		3core ,11 kV(UE) , XLPE Aluminium conductor with GI armouring
12.6.6	**Switchgear constructional Requirement**		
(a)	Thickness of sheet steel Frame, Frame enclosures, doors, covers and partitions	mm	Frame – 2.5 Doors/Covers – 2.0
(b)	Degree of protection		IP4X
(c)	Colour finish shade		Interior - Glossy white

Sr. No.	Description		Unit	Technical Particulars
				Exterior - Light grey semi-glossy shade 631 of IS:5
(d)	Earthing bus	i) Material		Copper
		ii) Size	mm x mm	25 x 6 (*)
(e)	Earthing conductor	i) Material		GS Flat
		ii) Size	mm x mm	50 x 10(*)
12.6.7	**Breaker Particulars**			
(a)	Circuit breaker type			Vacuum(With Surge Supressor)
(b)	Voltage, phases and frequency			12 kV, 50 Hz, 3 Ph
(c)	Rated operating duty			O - 3 min - CO - 3 min - CO
(d)	Rated current at reference ambient temperature (i) Incoming breakers		(ii) A	 (*)
	(ii) Outgoing breakers		A	(*)
(e)	Rated breaking capacity		kA (rms)	25
(f)	Rated making current		kA (peak)	62.5
(g)	Short time current withstand for 1 sec duration		kA (rms)	25.0
(h)	Total break time			Less than 5 cycles
(i)	Operating mechanism type (Normal)			Motor Charged spring for closing and tripping
	Operating mechanism type (Emergency)			Manual Spring Charged for closing and tripping
(j)	Minimum no. of auxiliary contacts			6 NO+ 6 NC
(k)	Withstand test voltage			
	(i) One minute power frequency		kV (rms)	28

Sr. No.	Description	Unit	Technical Particulars
	(ii) 1.2/50 μ sec impulse	kV (peak)	75
(l)	Auxiliary control voltage (i) For closing / tripping coil		110 V DC
	(ii) For spring charging motor		240 V AC
	(iii) For space heaters and lighting		240 V AC
(m)	Anti pumping feature		To be provided
(n)	Latching requirement		Trip free
12.6.8	**Current Transformers**		
(a)	Type		Cast resin
(b)	Class of insulation		Class E or better
(c)	Rated current ratio and burden (i) Incomers and bus couplers		(*)
	(ii) Outgoing feeders —		(*)
(d)	Accuracy class (i) Metering		1.0
	(ii) Protection		5P10 and PS for core connected to Restricted Earth fault relay
(e)	Short time 1 sec current rating	kA (rms)	25
(f)	Dynamic rating	kA (peak)	62.5
12.6.9	**Voltage Transformers**		
(a)	Type		Cast resin
(b)	Rated Voltage (i) Primary	V	11000/√3
	(ii) Secondary – S1	V	110/√3
(c)	Method of connection (i) Primary – P		Star, earthed
	(ii) Secondary – S1		Star, earthed
(d)	Application – S1		Metering and protection
(e)	Rated burden	VA	(*)

Sr. No.	Description	Unit	Technical Particulars
(f)	Accuracy class		Metering 1.0
			Protection 3.0
(g)	Rated voltage factor (i) Continuous		 1.1
	(ii) Short time		1.5
(h)	Insulation class		Class E or better
12.6.10 (a)	**Meters** Make		
(b)	Accuracy Class		
	(i) Indicating Meters		Class 1.0
	(ii) Energy Meter		Class 1.0
12.6.11	**Protective Relays**		
	Type		Numerical Type
	Auxiliary supply		110V DC
12.6.12	**Annunciations for 11KV Metal enclosed Switch board at Sewage Treatment Plant Substation**		
(a)	Following alarm annunciation shall be provided on the 11 kV Metal Enclosed Switchboard Incoming feeders (i) Incoming circuit breaker #1 trip (ii) Lockout relay #1 trip		
(b)	Outgoing feeders (i) Sewage treatment plant circuit breaker # 1 trip (ii) Sewage treatment plant circuit breaker # 2 trip (iii) Sewage treatment plant circuit breaker # 3 trip (iv) Sewage treatment plant circuit breaker # 4 trip (v) Terminal Sewage Pumping Station circuit breaker # 5 trip (vi) Terminal Sewage Pumping Station circuit breaker # 6 trip		
(c)	Spare windows 2 Nos.		
12.6.13	**Annunciations for 11KV Metal enclosed Switch gears at Terminal Sewage Pumping Station Substation and Process Air Blower Building .**		

Sr. No.	Description	Unit	Technical Particulars
(a)	Following alarm annunciation shall be provided on the respective 11 kV Metal Enclosed Switchgear modules Circuit breaker - trip Lockout relay - trip		
(b)	Spare windows - 2 Nos.		
12.6.14	**Cubicle Components**		
(a)	Each 11 kV circuit breaker cubicle shall be provided with the following minimum standard accessories One control switch 'trip-neutral-close' spring return to neutral position		
(b)	One control selector switch 'Local-remote stay-put' type		
(c)	Indicating lamps with series resistors (i) 'Red' for breaker in 'On' indication (this shall also supervise trip coil) (ii)'Green' for breaker 'Off' position (iii)'Blue' for breaker in 'Service' position (iv)'Amber' for breaker in 'Test' position (v)'White' for breaker closing spring 'Charged' Indicating lamps (iii), (iv) and (v) shall be provided when positive mechanical indicators for these conditions are not available/visible		
(d)	Mechanical trip push button to trip the breaker when control supply is lost. The push button shall be shrouded type		
(e)	One electrical anti pumping relay		
(f)	One double pole control supply switch and set of fuses		
(g)	Cubicle space heater of adequate capacity		
(h)	240V, 1 Phase, 50Hz, 5A, 3 pin receptacle with switch		
(i)	Cubicle lamp		
12.6.15	**Auxiliary A.C. Supply**		
	240 V, 1 Ph, 50 Hz supply shall be made available to each cubicle of 11 kV Metal Enclosed Switchboards separately for provision of following		
(a)	11 kV Motor space heater		
(b)	Spring charging motor		

Sr. No.	Description	Unit	Technical Particulars
(c)	Cubicle space heater		
(d)	Cubicle lamp		
(e)	240 V, 1 Ph, 50Hz 5A 3 pin receptacle with switch		

14. **11 KV/ 0.433kV Transformers**
15.

Sr. No.	Description	Unit	Technical Particulars
12.7.1	Make		As per Preferred Makes/Manufacturers of Part-6, General requirement.
12.7.2	Type		As per Specification
12.7.3	Applicable Standards		As per Specification
12.7.4	Rated output	KVA	(*)
12.7.5	Quantity required	Nos.	(*)
12.7.6	Transformer location		Outdoor
12.7.7	No load transformer ratio	kV/kV	11/0.433kV
12.7.8	Number of phases		3
12.7.9	Rated frequency	Hz	50
12.7.10	Impedence at all taps	%	Value as per IS 2026
12.7.11	Number of winding / material of conductor		Two/Copper
12.7.12 (a)	Method of connection HV winding		Delta
(b)	LV winding		Star
12.7.13	Vector group		Dyn 11

Sr. No.	Description	**Unit**	**Technical Particulars**	
12.7.14	LV Neutral		Solidly earthed	
12.7.15	Type of cooling		ONAN	
12.7.16	Tap changer		Full capacity, On load type on HV side with local marshalling box and Remote Tap Changing panel	
12.7.17	Tap range	%	+ 5 % to -15 %	
12.7.18	Tap step	%	2.5 %	
12.7. 19 (a) (b)	Terminal connection HV terminals LV terminals		Cable box suitable to 11 kV, UE,XLPE, Al.Conductor ,armoured cable of size (*) Cable box suitable for 650/1100 V XLPE/PVC, Al.Conductor armoured cables (*) For transformer ratings greater than or equal to 1000kVA should be suitable for termination of Non-Segregated Aluminium Bus duct (*)	
12.7.20 (a) (b)	Current Transformer On LV On LV Neutral		(*)	
12.7.21	LV Neutral earthing		LV Neutral shall be brought out through a 1.1 kV rated bushing, both inside the cable box for forming the 3 Ph, 4 wire system and outside the cable box for direct connections to earth by means of 25 x 3mm, GI earthing conductor(*)	
12.7.22	Insulation of Windings		H.V.	L.V.
(a)	One minute power frequency withstand voltage (dry and wet)	kV (r.m.s)	28	3.0

Sr. No.	Description	Unit	Technical Particulars	
(b)	1.2/50 micro second full wave impulse withstand voltage	kV (peak)	75	-
12.7.23	Insulation of bushings		H.V.	L.V. (Line and Neutral)
(a)	Rated Voltage of bushing	kV	12	1.1
(b)	One minute power frequency withstand voltage	kV (r.m.s)	28	3.0
(c)	1.2/50 microsecond full wave impulse withstand voltage	kV (peak)	75	-
(d)	Minimum creepage distance	mm	25mm/kV on 12kV	25mm/kV on 1.1 kV
12.7.24	Vacuum withstand capability of transformer main tank with bushings, radiations, fitting and accessories.		250mm of mercury	

2.8 415 V Metal Enclosed Switchgears (PCC) /MCC

Sr. No	Description	Unit	Technical Particulars
12.8.1	**Make**		Existing makes As perare Preferred Makes/Manufacturers of Part-6, General requirement.
12.8.2	**415 V Switchgear And Busbar Ratings**		
(a)	Rated voltage phase and		415 V, 3 Ph 50 Hz

Sr. No	Description	Unit	Technical Particulars
	frequency		
(b)	System Neutral Earthing		Solidly earthed
(c)	Maximum system voltage	V	476
(d)	One minute power frequency voltage		
	i) Power circuits	V	3000V (rms)
	ii) Control circuits	V	2000V (rms)
	iii) Aux. Circuits connected to Sec of CTS	V	2000V (rms)
(e)	Continuous current rating of Busbars under site reference Ambient Temperature and type & material	Rating Material	(*) Copper
(f)	Busbar insulation		Fully insulated encapsulation in epoxy resin with moulded caps protecting all joints
(g)	Reference Ambient Temperature	^{o} C	45
(h)	Maximum Temperature of Busbars, Droppers and Contacts at Continuous current rating under site ambient temperature	^{o} C	85^{o} C for bus bars and non silver plated joints 100^{o} C for silver plated joints
(i)	Short Circuit current withstand for Busbars and droppers (i) Short time 1 sec	kA (rms)	50
	(ii) Dynamic Rating	kA (peak)	125
12.8.3	**Switchgear Constructional**		

Sr. No	Description		Unit	Technical Particulars
	Requirement			
(a)	Type of Construction			Single front fixed type (Except for Circuit Breaker)
(b)	Thickness of sheet steel (i) Frame, Frame enclosures, doors, covers and partitions		mm	Cold Rolled – 2.0
(c)	Degree of protection			IP 54 indoor and IP55 for outdoor
(d)	Colour finish shade			Interior : Glossy white
				Exterior : Light grey semi glossy Shade 631 of IS-5
(e)	Earthing bus	Material		Copper
		Size	mm x mm	25x6
	Earthing conductor	Material		GS
		Size	mm x mm	50 x 10(*)
(g)	Minimum clearances in air of live parts (i) Phase to Phase		mm	25.4
	(ii) Phase to Earth		mm	19.4
(h)	Cable entry to cubicles			(*)
12.8.4	**Instrumentation Transformers**			
(a)	Current transformer			
	(i) Ratio			(*)
	(ii) Burden		VA	(*)
	(iii) Accuracy Class			1.0

Sr. No	Description	Unit	Technical Particulars
(b)	Voltage transformer		
	(i) Ratio		(415V √3) / (110V √3)
	(ii) Burden	VA	50
	(iii) Accuracy Class		1.0

16.415 V Power Capacitor and Control Panel

Sr. No	Description	Unit	Technical Particulars
12.9.1	**General**		
(a)	Make		As per Preferred Makes/Manufacturers of Part-6, General requirement.
(b)	Rated Capacity	KVAR	(*)
(c)	Rated voltage	V	433
(d)	Rated frequency and phases		50 Hz, 3 Phase
(e)	Ambient temperature	° C	45
(f)	Cable gland required		Yes
(g)	Type of cable		1.1kV, XLPE, Al. Conductor
(h)	Size of cable		(*)
(i)	Cable entry		(*)
12.9.2	**Constructional Requirement**		
(a)	Thickness of sheet steel i) Frame, Frame enclosures, doors covers and partition	Mm	Cold rolled 2.0
(b)	Degree of protection		IP 54
(c)	Colour finish shade		Interior : Glossy white Exterior : Light Grey Semi

Sr. No	**Description**		**Unit**	**Technical Particulars**
				Glossy Shade 631 of IS- 5
(d)	Earthing bus	Material		Copper
		Size	mm x mm	25x6 (*)
(e)	Earthing conductor	Material		Copper
		Size	mm x mm	40 x 6 mm (*)
12.9.3	**Design Requirement**			
(a)	Insulation level		kV (rms)	3.0
(b)	Capacitor bank connection			Delta
(c)	Short circuit withstand for busbars i) Short time (1 sec)		kA (rms)	35
	ii) Dynamic		kA (peak)	87.5
(d)	Type of switching			Automatic switching responsive to power factor through power factor sensing relay
(e)	Switching steps			Minimum 8 steps
(f)	Rating of contactor			To suit KVAR unit
(g)	Incomer switch current rating			To suit rated capacity of KVAR
(h)	Busbars			Copper

17. **Diesel Standby Generator Sets**

Sr. No.	Description	Unit		Technical Particulars
12.10.1	**General**			As per Preferred Makes/Manufacturers of Part-6,General requirement.
(a)	Set Manufacturer			
(b)	Quantity & Type			2Sets with AMF Control Panels and Synchronising panel.
	Alternator			
	Manufacturer			As per Preferred Makes/Manufacturers of Part-6,General requirement.
(b)	Type			Salient pole ,Revolving field, Brushless type with a damper cage and dynamically balanced.
(c)	Rating		KVA	(*)
(d)	Voltage	kV		11
(e)	Frequency	Hz		50
(f)	Overload Capacity			10% overload for 1 hour in any 12 hours
(g)	Insulation			Class H with Class F temperature rise
(h)	Short circuit current			3 times full load current for 10 sec
(i)	Degree of protection			IP 23 with IP 54 for terminal box
(j)	Current			(*)
(k)	Power Factor			0.8
12.10.3	**Diesel Engine**			
	Manufacturer			As per Preferred Makes/Manufacturers of Part-6, General requirement.
(b)	Type			Four stroke, multi cylinder, direct Injection , compression ignition type

Sr. No.	Description	Unit	Technical Particulars
			turbocharged
(c)	Rating	HP	As per requirement
(c)	Speed	rpm	1500
(d)	Fuel Specification		As per manufacturer's standard
(e)	Engine Starting		As per manufacturer's standard
(f)	Overload Capacity		10% overload for 1 hour in any 12 hours
(g)	Governor		The governor shall be electronic,Class A2 with provision for paralleling of DG sets and load sharing.
(h)	Exhaust system		As per the requirement of Center /StatePollution Control Board or Pollution Control Committee
12.10.4	**Day oil tank capacity**	Litres	As per requirement

2.9 Variable Frequency Drives

Sr. No.	Description	Unit	Technical Particulars
12.119.1	Make		Existing makes As perare Preferred- Makes/Manufacturers of Part 6, General requirement.
12.119.2	Type of Drive		Inverter Controlled A.C Drives
12.119.3	Rated voltage, frequency and phases		415, V 50 Hz, 3 Phase

Sr. No.	Description	Unit	Technical Particulars
~~1~~2.~~11~~9.4	Variation in voltage		415 V ± 10
~~1~~2.~~11~~9.6	Variation in frequency		50 Hz ± 5
~~1~~2.~~11~~9.7	Type of Duty		100% continuous, 150 % overload for 2 minute once in period of 24 hours, 200 % overload for 10 seconds once in period of 24 hours
~~1~~2.~~11~~9.~~1~~ ~~2~~8	Design Ambient Temperature		45^0C
~~1~~2.~~11~~9.~~1~~ ~~3~~9	Overall Harmonic Limitation		Less than 5% as per limits given in IEC 61800
~~1~~2.~~11~~9.~~1~~ ~~4~~10	Application		~~As per Clause 12.5.10 of Part 12~~ As per Particular Electrical Plant Requirements
~~1~~2.~~11~~9.~~1~~ ~~4.1~~11	Interfaces		Serial or Profibus

18.**Battery**
19.

Sr. No.	**Description**	**Unit**	**Technical Particulars**
12.12.1	Make		As per Preferred Makes/Manufacturers of Part 6, General requirement.
12.12.2	Type of battery		Ni-Cd
12.12.3	Applicable Standards		As per Specification
12.12.4	Number of battery banks required		(*)
12.12.5	Ambient conditions		Min. Temp. 25° C
			Max. Temp 45° C
12.12.6	D.C. system voltage	V	110
12.12.7	Ampere hour capacity of battery at 27 Deg. C at 5 hour rate to give final cell voltage of 1.16 volts/cell	Ah	As per the Requirement
12.12.8	Momentary load/duration	A	To be furnished by the Bidder
12.12.9	Emergency load/duration	A	
12.12.10	Continuous load/duration	A	
12.12.11	Nominal voltage	V	1.2 V per cell
12.12.12	Cell voltage - initial/final	V	1.42/1.14 V
12.12.13	Number of cells per bankrequired to give rated voltage	Nos	(*)
12.12.14	Number of spare cells per bank	Nos	(*)
12.12.15	Mounting arrangement		Multi tier
12.12.16	Charging method		Float cum boost charging

20. Battery Charger

Sr. No.	Description	Unit	Technical Particulars
12.13.1	**General**		
(a)	Make		As per Preferred Makes/Manufacturers of Part 6, General requirement.
(b)	Applicable Standards		As per Specification
(c)	Number required (i) Battery charger	 Nos	 (*)
(d)	Rated Output voltage (DC)	V	110
(e)	Rated Output	kW	(*)
(f)	DC System Earthing		Unearthed
(g)	Voltage regulation from no load to rated load	%	± 1
(h)	Ambient Design Temperature	Deg. C	45° C
(i)	Busbar material & size	-	Copper , size as per Requirement
(j)	Overall dimensions	mmxmmxmm	To be furnished by the Bidder
12.13.2	**Battery Details**		
(a)	Float/Trickle charging current of battery	mA	200
(b)	Boost Charging Current of Battery (Maximum)	A	10
(c)	Boost Charging Voltage of	V	142

Sr. No.	**Description**	**Unit**	**Technical Particulars**
	Battery (maximum)		
(d)	Maximum Time for Boost charging of Battery	hr	5
(e)	Battery capacity & no. of cells	Ah	(*)
		Nos.	(*)
12.13.3	**AC System Data**		
(a)	Supply Voltage	V	415
	Phase		3
(b)	(i) Variation in supply Voltage	%	± 10
	(ii) Variation in supply frequency	%	± 5
(c)	Short Circuit level	kA	50
(d)	Type of earthing		Solidly Earthed
12.13.4	**Performance**		
(a)	DC voltage setting adjustment for float charger		±10% of nominal voltage
(b)	Voltage stabilisation for constant voltage regulator		±1% of set D.C. voltage, with AC input variation and DC load variation from 0 to 100%
(c)	Maximum permissible variation in DC voltage (no load to full load)		± 1%
(d)	D.C. voltage setting adjustment for boost charging		70% to 100% of max. boost charging voltage

Sr. No.	**Description**		**Unit**	**Technical Particulars**
(e)	D.C. current adjustment for boost Charging			30% to 100% of max. boost charging current
(f)	Current stabilisation for constant current regulator for boost charger			± 2%
(g)	Minimum permissible power factor to rated continuous load			0.8
(h)	Permissible ripple content at rated continuous load			3% (maximum)
(i)	Relay for auto changeover from Float to boost mode to be provided (in case of float-cum-boost charger)			Yes
12.13.5	**Constructional Features**			
(a)	Thickness of sheet steel Frame, Frame enclosures, doors, covers and partition		— mm	Cold rolled 2.0
(b)	Degree of protection			IP 42
(c)	Colour finish shade			Interior : Glossy white Exterior : Light Grey Semi Glossy Shade 631 of IS 5
(d)	Earthing bus	Material		Copper
		Size	mm x mm	25 x 6(*)
(e)	Earthing conductor	Material		GS

Sr. No.	**Description**		**Unit**	**Technical Particulars**
		Size	mm x mm	40 x 6(*)
(f)	Cable entry			Bottom
(g)	Cable Sizes (i) Battery		sq.mm	(*)
	(ii) DC output		sq.mm	(*)
	(iii) AC input		sq.mm	(*)

21. **DC Distribution Board**

Sr. No.	**Description**	**Unit**	**Technical Particulars**
12.14.1	**General**		
(a)	Make		As per Preferred Makes/Manufacturers of Part 6, General requirement.
(b)	Applicable standards		As per specification
(c)	DC System voltage (Nominal)	V	110
(d)	DC System Earthing		Unearthed
(e)	Ambient Design Temperature	Deg. C	45° C
(f)	Bus bar material , rating and size		Copper , Rating & Size (*)
12.14.2	**DC Bus Load**		
(a)	Total continuous DC load	A	(*)
(b)	Short time loads (Additional to		

Sr. No.	**Description**		**Unit**	**Technical Particulars**
	continuous loads)			
	(i) DC lights/Facia lamps		A	(*)
	(ii) Starting current and duration of Largest Connected DC Motor		A	(*)
			Secs	(*)
12.14.3	**Constructional Features**			
(a)	Thickness of sheet steel Frame, Frame enclosures, doors, covers and partition		mm	Cold rolled 2.0
(b)	Degree of protection			IP 54
(c)	Colour finish shade			Interior : Glossy white
				Exterior : Light Grey Semi Glossy Shade 631 of IS 5
(d)	Earthing bus	Material		Copper
		Size	mm x mm	25 x 6(*)
(e)	Earthing conductor	Material		GS
		Size	mm x mm	40 x 6(*)
(f)	Cable entry			(*)
(g)	Cable Sizes (i) DC Input from Battery		sq.mm	(*)
	(ii) DC output to Load		sq.mm	(*)

2.10 Cables

Sr. No.	Description	Unit	Technical Particulars
~~12.15.1~~	~~**11kV (UE) XLPE Insulated Power Cables**~~		
~~(a)~~	~~Make~~		~~As per Preferred Makes/Manufacturers of Part 6, General requirement.~~
~~(b)~~	~~Applicable Standards~~		~~As per specification~~
~~(c)~~	~~Cable size selection~~		~~As per specification~~
~~(d)~~	~~Continuous current rating with cable laid in air/ ground under specified ambient temperature~~	~~A~~	~~(*)~~
~~(e)~~	~~Recommended minimum bending radius~~	~~mm~~	~~To be furnished by the bidder~~
~~(f)~~	~~Standard length of cable on each drum~~	~~mts~~	~~(*)~~
~~1~~2.15~~0~~.~~2~~1	**1100 V Grade XLPE Insulated Power Cables**		
(a)	Make		As per Preferred Makes_____/ Manufacturers~~ of Part 6, General requirement~~.

Sr. No.	Description	Unit	Technical Particulars
(b)	Applicable Standards		As per specification
(c)	Cable size selection		As per specification
(d)	Recommended minimum bending radius	mm	To be furnished by the bidder
(e)	Standard length of cable on each drum	mts	(*)
~~1~~2.1~~5~~0.~~3~~2	**1100 V Grade PVC Insulated Power Cables**		
(a)	Make		As per Preferred Makes_____/ Manufacturers ~~of Part-6, General requirement.~~
(b)	Applicable Standards		As per specification
(c)	Cable size selection		As per specification
(d)	Overall diameter of the cable	mm	To be furnished by the bidder
(e)	Recommended minimum bending radius	mm	To be furnished by the bidder
(f)	Standard length of cable on each drum	mts	(*)
~~1~~2.1~~5~~0.~~4~~3	**650/1100 V Grade PVC Insulated Control Cables**		
(a)	Make		Reputed make
(b)	Applicable Standards		
(c)	Rated voltage	V	As per requirement
(d)	Cable size selection		As per specification

~~22.**Lighting Fixtures and Accessories**~~

~~**Sr. No.**~~	~~**Description**~~	~~**Unit**~~	~~**Technical Particulars**~~
~~12.16.1~~	~~**General**~~		
~~(a)~~	~~Make~~		~~As per Preferred Makes/Manufacturers of Part-6, General~~

Sr. No.	**Description**	**Unit**	**Technical Particulars**
			requirement.
(b)	Type		As per specification
(c)	Illumination levels at various premises		As per Building Services , Clause 12.5.13 of Part 12- Particular electrical requirements
(d)	Normal supply voltage, phase and frequency	AC	240 V, 1 ph, 2 wire, 50 Hz
		DC	110 V, 2 wire, uncarthed
(e)	Variation in supply:		
	(i) Voltage (AC & DC)	%	± 10
	(ii) Frequency	%	± 5
	(iii) Combined voltage & frequency	%	± 10
(f)	Design ambient air temperature	^{0}C	45° C
12.16.2	Luminaric terminal suitable for		
(a)	Indoor area		
	(i) Conductor material		Copper
	(ii) Cable size	Coresxmm^2	(*)
(b)	Outdoor area		
	(i) Conductor material		Copper
	(ii) Cable size	Coresxmm^2	(*)

Sr. No.	**Description**	**Unit**	**Technical Particulars**
12.16.3	Luminaire earthing terminal suitable for		
	(i) Conductor material		G. I. wire
	(ii) Conductor size	SWG	(*)

23. **Lighting System and Equipment**
24.

Sr.No.	**Description**	**Unit**	**Technical Particulars**
12.17.1	**System Particular**		
(a)	**Voltage**		
	(i) 3 Phase, 4 wire 50 Hz system		
	• Rated	• V	415
	• Maximum	• V	476
	• One minute withstand voltage	•	3000 V AC.
	(ii) D.C. system		
	• Rated	V	110
(b)	System short circuit level		
	(i) At 415 V, A.C.	kA (rms)	10
	(ii) At 110 V.D.C.	kA (D.C.)	6
(c)	Reference ambient temperature	^{0} C	45^{0} C
12.17.2	**Distribution Board/Panels**		

Sr.No.	Description	Unit	Technical Particulars
(a)	Main, floor mounted distribution boards		
(i)	Main Lighting distribution board(A.C.)		
	• Make	•	As per Preferred Makes/Manufacturers of Part 6, General requirement.
	• Type		Floor standing ,sheet steel Enclosed
	• Degree of protection	•	IP 54
	• Bus bar material	•	Copper
	• Bus bar current rating	• A	(*)
	• Short circuit current rating	• kA	(*)
	• Cable entry	•	Based on Layout Top or bottom
	• Location	•	Indoor
(ii)	Emergency lighting panel (D.C.)		
	• Make	•	As per Preferred Makes/Manufacturers of Part 6, General requirement.
	• Type	•	Wall mounting , sheet steel Enclosed
	• Degree of protection	•	IP 54
	• Bus bar material	•	Copper
	• Bus bar current rating	• A	(*)

Sr.No.	**Description**	**Unit**	**Technical Particulars**
	• Short circuit current rating	• kA	• (*)
	• Cable entry	•	Based on Layout Top or bottom
	• Location	•	Indoor
(iii)	Single phase DBs, wall/structure mounting		
	SLDB for indoor area		
	• Make	•	As per Preferred Makes/Manufacturers of Part 6, General requirement.
	• Type	•	Wall mounting ,sheet steel enclosed
	• Degree of Protection		IP 54
(iv)	SLDB for outdoor area		
	• Make	•	As per Preferred Makes/Manufacturers of Part 6, General requirement.
	• Type	•	Wall mounting ,sheet steel enclosed
	• Degree of Protection	•	IP 55
(v)	Paint Finish		
	(i) Colour shade:	(ii)	Interior : Glossy white
			Exterior: Light gray semi glossy shade 631 of IS:5
12.17.3	**Street Light Poles And Flood Light Poles** Street Light Pole		

Sr.No.	**Description**	**Unit**	**Technical Particulars**
(a)			
	Total Height:	m	10
	Quantity:	Nos.	(*)
(b)	Floodlight Light Pole		
	Total height :	mts.	10
	No. Of floodlights to be fixed per pole	No.	(*)

25. **Earthing and Lightning Protection System**
26.

Sr. No.	**Description**	**Technical Particulars**		
		Size	**Material**	**No.of Leads & Quantity**
12.18.1 (a)	**Main Earthing Grid** Buried in earth	50x10 mm	MS	Quantity as per requirement
(b)	Buried in floor slabs in buildings	50x10 mm	MS	Quantity as per requirement
12.8.2	**Conductor Leads To**			

Sr. No.	Description	Technical Particulars		
	Equipment (above ground)			
(a)	Transformers			
(i)	Transformer neutral to bottom of tank	50x10 mm	GS	Number of Leads As per relevant Standards , Quantity as per requirements
(ii)	From bottom of tank to earth grid	50x10 mm	GS	
(iii)	Transformer tanks and radiator bank	50x10 mm	GS	
(b)	Diesel Generator Set			
(i)	DG Set neutral earthing	50x10 mm	GS	
(ii)	DG Set body earthing	50x10 mm	GS	
(c)	Fence posts and gates (Flex. braid)	50x10 mm	GS	
12.18.3	11kVMetal Enclosed Switchboard, ,415Vswitch gear/ MCC.	50x10 mm	GS	
12.18.4	Motors			
(a)	415V Motors above 10 kW	25x3 mm	GS	
(b)	415V Motors up to 10 kW	8 SWG	GI wire	
(c)	Fractional horse power motors	10 SWG	GI wire	
12.18.5	**Other Items**			
(a)	Capacitor panel, Battery charger panel, DC distribution board , Main lighting D.B, Control panels and sub-lighting distribution boards	40x6 mm	GS	
(b)	Hand Rails	25x3 mm	GS	
(c)	Cable trays	25x3 mm	GS	
(d)	Tanks	25x3 mm	GS	
(e)	Junction boxes	8 SWG	GI wire	
(f)	Lighting fixtures, receptacles, lighting conduits	12 SWG	GI wire	
(g)	Push button stations, limit	14 SWG	GI wire	

Sr. No.	Description	Technical Particulars		
	switches			
12.18.6	**Crane rail**	25x3 mm	GS	
12.18.7	Street lighting, flood lighting poles and junctions boxes	25x3 mm	GS	
12.18.8	Metallic non current carrying structures	25x3 mm	GS	
12.18.9	**Lightning Conductors**			
(a)	Lightning protection down comers for building	40x6 mm	GS	
(b)	Lightning protection horizontal roof conductor for building	40x6 mm	GS	
12.18.10	**Electrodes**	40 (mm) NB	Heavy duty GI pipe 3000 mm long	Quantity as per requirements
(a)	Pipe electrode			

Note :

(i) Any requirement /features /provisions not specifically mentioned in the Specification, but are necessary for trouble free and smooth operation of the Plant System shall be included.

(ii) (*) – The numbers, ratings–, sizes etc shall as per the existing specificationshave to be worked out by the contractor during execution and to be approved by the Engineer.

End of Part 12A